LETTER TO THE EDITOR

How the use of surgical masks during COVID-19 pandemic can induce skin effects

Dear Editor,

During COVID-19 pandemic, it is necessary to use personal protective equipment (in particular, face masks) to avoid contracting the disease and, at the same time, the obligation to use it is imposed by some countries in an attempt to limit the spread. Despite the widespread use of masks and the role they can play in causing/aggravating skin diseases,[1] both high-resolution studies and data on their structural alterations related to utilization are lacking. For this reason, as an independent academic group, we studied the immediate structural alterations on surgical masks (the most commonly utilized) after a short but continuous use, to ascertain if and how they can contribute to skin problems.

We performed environmental scanning electron microscopy (ESEM) analysis of internal part of a control mask (Zhi Shan – Standard Earloop Medical Mask, model no. ZSE001) to exclude alterations of the structure related to the manufacturer and/or storage (Fig. 1a,b), and of 10 masks worn continuously for 1.5 h by 10 volunteers (Fig. 2a,b).

The analysis revealed deformations in the structure of the 10 masks used (Fig. 2a), probably due to the manipulation of the wearers since the masks were perfectly intact before utilization (Fig. 1b). These deformations can reduce the porosity of the masks, thus going to explain the alterations in the levels of accumulation of oxygen and carbon dioxide in the space between the face and the masks themselves. These changes have already been reported as they can induce respiratory complications,[2] and they affect not only the respiratory tract, but also the skin. To this must be added the changes in humidity and temperature between the masks and the skin, caused by the masks, which can involve a change in the skin microenvironment.[3] Dysregulation of the skin microenvironment can cause inflammatory skin diseases, with cyclical alternation of initiation and propagation stages.[4]

The presence of dirt and residual material on the internal surface of the masks (Fig. 2b) contributes to occluding the pores of the masks, worsening the alteration effect of the air between the masks and the skin.

A further aggravation of these modifications results from the prolonged duration of wearing the masks. After a month of using surgical masks, two out of 10 subjects of this study reported discomforts while wearing the mask. They described an increase in the itching sensation. Another subject reported acne rosacea at the cheek level. This person had never had this pathology, previously. Antibiotic therapy with Lymecycline was taken orally for 28 days, and an Ivermectin ointment was administered topically for 3 months to completely resolve the disease. Skin itching, irritations and infections related to the use of masks have already been documented,[1,5–7] even after short periods of use of the devices.[8]

To these aspects, we can add the abrasions of the mask at the nanometric level, related to the contact between the masks and the skin, which can cause contact dermatitis.[9,10]

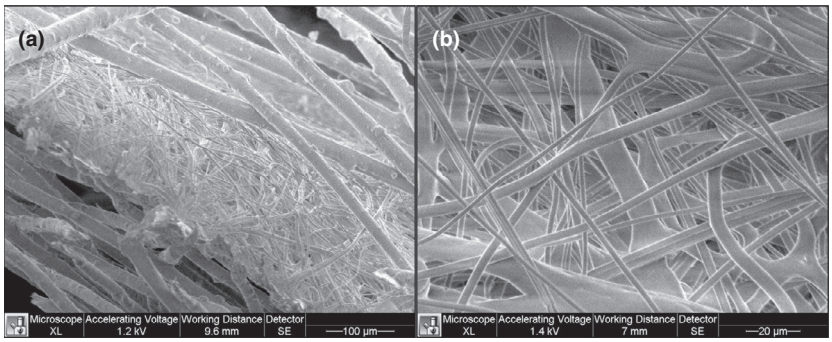

Figure 1 ESEM analysis of the control mask. (a) Three ply construction is evident, with the filter in the central layer presenting fibre of smaller diameter than the other layers and with a denser texture. (b) Central part of the internal surface presents fibres of different diameters (from 1.85 to 11.08 μm), with a non-regular braided path. There are no structural deformities, such as crushing or creasing.

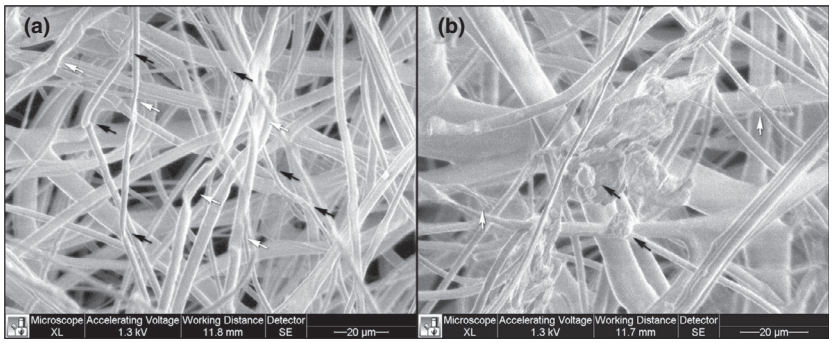

Figure 2 ESEM analysis of the central part of the internal surface of a surgical mask utilized for 1.5 h. (a) Bending (black arrows) and flattening (white arrows) of the fibres are evident. (b) The presence of dirt mixed with organic material (probably, breathing products and cell fragments – black arrows) may be noted. The organic material appears in the form of particles of the order of 5-10 μm and is included in irregular annexes with dimensions of the order of a few tens of μm. The deterioration of fibres (white arrows) can also be seen.

Further considerations can be made about the fact that anallergic or hypoallergenic fabrics are not always guaranteed for the construction of the masks.

Since the suspension of masks use is currently unthinkable, considering that their surface is not smooth and uniform, their use can be associated with a progressive topical drug delivery in order to heal the mask-induced pathologies and/or prevent their onset.

The high-resolution ESEM can be a tool to provide further information for the creation and analysis of masks that are both protective, but also safe and useful for the skin.

Conflicts of interest

The authors have no conflict of interest to declare.

Funding sources

None.

S. Veronese,* P. Bernardi, A. Sbarbati
Department of Neuroscience, Biomedicine and Movement Sciences, University of Verona, Verona, Italy
*Correspondence: S. Veronese. E-mail: sheila.veronese@univr.it

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DOI: 10.1111/jdv.16905